Claims

1. Device to measure individual cell voltages (Uz) of the cells (Z1 to Zn) in a cell stack (ZS) of an energy accumulator, especially of an energy accumulator in a motor vehicle electrical system,

characterized in that

a series circuit of two diodes (D1a-D1b to Dna-Dnb), which conduct current in the direction from the minus pole to the plus pole of the cell, is arranged in parallel to each cell (Z1 to Zn),

a changeover switch is provided which features a number of terminals assigned to switch positions corresponding to the number of cells (Z) of the cell stack (ZS), which are connected via a capacitor (C1 to Cn) in each case to the connection points of the diodes (D1a-D1b to Dna-Dnb) assigned to the cells,

a reference circuit (REF) is provided which features two series-connected diodes (D3, D4), with the anode of one diode (D4) being connected to reference potential (GND) and to the cathode of the other diode (D3).

a differential amplifier (Diff1) is provided, of which the non-inverted input is connected to the output of the changeover switch (UM) and of which the inverted input is connected via a capacitor (C3) to the connection point of the two diodes (D3, D4),

a controlled rectifier (GLR) is provided of which the input is connected to the output of the differential amplifier (Diff1) and at the output of which a direct current (V=) related to reference potential (GND) proportional to the cell voltage (Uz) of the cells selected in each case using the changeover switch (UM) can be tapped off.

a first controlled alternating current source (I1) is provided is arranged between the non-inverting input of the differential amplifier (Diff1) and reference potential (GND)

a second controlled alternating current source (I2) is provided which is arranged between the inverting input of the differential amplifier (Diff2) and reference potential (GND)

a clock control (ST) is provided which features an oscillator (OSZ) which outputs an oscillator clock signal (T1) and features a frequency divider (DIV) which outputs a

divider signal (T2), with the two alternating current sources (I1, I2) and the rectifier (GLR) being controlled by the oscillator clock (T1) and the changeover switch (UM) being controlled by the divider signal (T2).

2.Device in accordance with claim 1, characterized in that the rectifier (GLR) is embodied as a synchronous demodulator (Ampl, Diff2) controlled by the oscillator clock (T1).

3. Method for operating the device in accordance with claim 1,

characterized in that

to measure the cell voltage (Uz) of a specific cell (Z1 to Zn) of the cell stack (ZS) a first, square-wave alternating current of a specific frequency (T1) and amplitude is injected into the capacitor (C1 to Cn) assigned to the cell, which produces an alternating voltage (V1) which corresponds to the cell voltage (Uz), multiplied by the on-state voltages (Ud) of the two diodes (D1a-D1b to Dna-Dnb) lying in parallel to the cell (Uz).

an alternating current which is equal in frequency and amplitude to the first square-wave alternating current is

injected into the capacitor (C3) assigned to the reference circuit (REF), which produces an alternating voltage (V2) related to ground (reference potential GND) which corresponds to the on-state current (2*Du) of the two diodes (D3, D4) assigned to the reference circuit (REF),

the difference (V1-V2) between the two alternating voltages (V1, V2) is formed, with an alternating voltage corresponding to the cell voltage (Uz) arising, and

the alternating voltage corresponding to the cell voltage (Uz) is rectified which produces a direct voltage (V=) corresponding to the cell voltage (Uz) related to ground (reference potential GND).

4. Method in accordance with one of the previous claims, characterized in that this method is applied consecutively to all cells (Z1 to Zn) of the cell stack (ZS).

5. Method in accordance with claim 3 or 4, characterized in that the frequency (clock frequency T1) of the alternating currents injected into the capacitors (C1 to Cn and C3) is selected to be high enough so that the capacitors do not significantly charge or discharge during the oscillation period.

6. Method in accordance with claim 3 or 4, characterized in that the amplitudes of the alternating currents injected into the capacitors (C1 to Cn and C3) lie within the µA range.

7. Method in accordance with Claim 3 or 4, characterized in that the direct current voltage (V=) corresponding to the cell current (Uz) of each cell (Z1 to Zn) related to ground (reference potential GND) is subjected to a limit value comparison at the upper and a lower limit value, in which case exceeding the upper limit value indicates an overvoltage of the cell and falling below the lower limit value indicates a short-circuit the cell.

8. Method in accordance with claim 3 or 4, characterized in that the direct current voltage values (V=) corresponding to the cell voltages (Uz) of each cell (Z1 to Zn) related to ground (reference potential GND) are stored, in which case during charge balancing, the slow balancing of individual cell voltages (Uz) can be detected and the termination of the charging or discharging process can be defined as well as a long-term supervision of each individual cell (Z1 to Zn) for a drop in the capacitance or an increase in the self-discharge or the internal resistance.